

BAB II

PERENCANAAN PELAT LANTAI

2.1 Pembebanan Pelat

Mutu baja : $f_y := 240 \text{ Mpa}$

Mutu beton : $f_c := 18.675 \text{ Mpa}$

Tebal pelat yang direncanakan :

- Tebal pelat lantai $T_p := 120 \text{ mm}$

Beban - beban untuk bangunan rumah berdasarkan Peraturan Pembebanan Indonesia untuk Gedung 1983 (PPIUG 1983) :

1. Beban Mati (DL) :

- Berat sendiri pelat $W_{plt} := 0.12 \cdot 2400 = 288 \text{ kg/m}^2$
- Berat finishing (2 cm) $W_f := 2 \cdot 21 = 42 \text{ kg/m}^2$
- Berat ducting & Plumbing $W_{dp} := 40 \text{ kg/m}^2$
- Berat keramik $W_k := 1 \cdot 24 = 24 \text{ kg/m}^2$
- Berat plafond & penggantung $W_{pl} := 18 \text{ kg/m}^2$

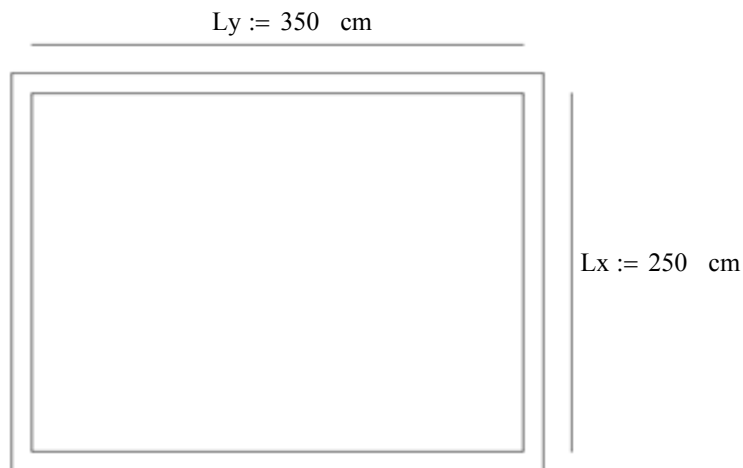
$$DL := W_{plt} + W_{dp} + W_f + W_k + W_{pl} = 412 \text{ kg/m}^2$$

2. Beban Hidup (LL) : (PPIUG 1983 tabel 3.1)

$$LL := 250 \text{ kg/m}^2$$

kombinasi pembebanan (q_u)

$$q_u := 1.2DL + 1.6 \cdot LL = 894.4 \text{ kg/m}^2$$



$$L_{yn} := 350 - \left(\frac{15 + 15}{2} \right) = 335 \text{ cm}$$

$$L_{xn} := 250 - \left(\frac{15 + 15}{2} \right) = 235 \text{ cm}$$

$$\beta_1 := \frac{L_{yn}}{L_{xn}} = 1.43 < 2 \quad \rightarrow \quad \text{(pelat dua arah)}$$

Harga β tergantung dari mutu beton, yaitu menurut SNI 2847 pasal 3.3.2 butir 7 atau PBI 1971 10.2.7.3, maka untuk $30 \leq f'_c \leq 55$ Mpa

$$\text{untuk } f_c = 18.675 \text{ Mpa} \rightarrow \beta := 0.85$$

Adapun data - data perencanaan untuk penulangan lantai

- Tebal pelat : $T_p := 120 \text{ mm}$
- Tebal decking $s := 20 \text{ mm}$
- Diameter tulangan rencana $\phi := 8 \text{ mm}$
- Mutu tulangan baja $f_y = 240 \text{ Mpa}$
- Mutu beton $f_c = 18.675 \text{ Mpa}$

$$d_x := 120 - 20 - (0.5 \cdot 8) = 96 \text{ mm}$$

$$d_y := 120 - 20 - 8 - (0.5 \cdot 8) = 88 \text{ mm}$$

$$\beta = 0.85$$

$$b_l := 1000 \text{ mm}$$

$$q_u = 894.4 \text{ kg/m}^2$$

Berdasarkan SNI 2847 pasal 10.4.3 :

$$\rho_{\text{balance}} := \frac{0.85 \cdot \beta \cdot f_c \cdot \left(\frac{600}{600 + f_y} \right)}{f_y} = 0.0402$$

$$\rho_{\text{max}} := 0.75 \cdot \rho_{\text{balance}} = 0.0301$$

Berdasarkan SNI 03-2847-2002 pasal 9.12.2.1

$$\rho_{\text{min}} := 0.0018 \text{ (keperluan minimum untuk tulangan susut pelat)}$$

$$m := \frac{f_y}{0.85 \cdot f_c} = 15.12$$

Dengan menggunakan koefisien momen PBI 1971 tabel 13.3.2 didapat persamaan momen

$$\text{sebagai berikut : } \frac{L_{yn}}{L_{xn}} = 1.43$$

$$M_{lx} \rightarrow \text{nilai } x_1 := 53$$

$$M_{tx} \rightarrow \text{nilai } x_2 := 53$$

$$M_{ly} \rightarrow \text{nilai } x_3 := 38$$

$$M_{ty} \rightarrow \text{nilai } x_4 := 38$$

$$M_{lx} := 0.001 \cdot q_u \cdot L_{xn}^2 \cdot x_1 = 2617841.72 \text{ Nmm}$$

$$M_{tx} := -0.001 \cdot q_u \cdot L_{xn}^2 \cdot x_2 = -2617841.72 \text{ Nmm}$$

$$M_{ly} := 0.001 \cdot q_u \cdot L_{xn}^2 \cdot x_3 = 1876943.12 \text{ Nmm}$$

$$M_{ty} := -0.001 \cdot q_u \cdot L_{xn}^2 \cdot x_4 = -1876943.12 \text{ Nmm}$$

2.2 Perhitungan Penulangan

- **Perhitungan penulangan pelat arah x**

$$M_u := M_{lx} = 2617841.72 \quad \text{Nmm}$$

$$M_n := \frac{M_u}{0.8} = 3272302.15 \quad \text{Nmm}$$

$$R_n := \frac{M_n}{b \cdot d \cdot x^2} = 0.3551 \quad \frac{\text{N}}{\text{mm}^2}$$

$$\rho_{\text{perlu}} := \frac{1 \cdot \left(1 - \sqrt{1 - 2 \frac{m \cdot R_n}{f_y}} \right)}{m} = 0.0015$$

$$\rho_{\text{perlu}} = 0.0015 < \rho_{\text{min}} = 0.0018$$

$$A_{\text{perlu}} := \rho_{\text{min}} \cdot b \cdot d \cdot x = 172.8 \quad \text{mm}^2$$

pakai tulangan $\phi 8 - 150$

$$A_s := 7 \cdot 0.785 \cdot 8^2 = 351.68 \quad \text{mm}^2 \quad \blacksquare > \blacksquare \quad A_{\text{perlu}} = 172.8 \quad \text{mm}^2$$

- **Perhitungan penulangan pelat arah y**

$$M_u := M_{ly} = 1876943.12 \quad \text{Nmm}$$

$$M_n := \frac{M_u}{0.8} = 2346178.9 \quad \text{Nmm}$$

$$R_n := \frac{M_n}{b \cdot d \cdot y^2} = 0.303 \quad \frac{\text{N}}{\text{mm}^2}$$

$$\rho_{\text{perlu}} := \frac{1 \cdot \left(1 - \sqrt{1 - 2 \frac{m \cdot R_n}{f_y}} \right)}{m} = 0.0015$$

$$\rho_{\text{perlu}} = 0.0015 < \rho_{\text{min}} = 0.0018$$

$$A_{\text{perlu}} := \rho_{\text{min}} \cdot b \cdot d \cdot y = 158.4 \quad \text{mm}^2$$

pakai tulangan $\phi 8 - 150$

$$A_s := 7 \cdot 0.785 \cdot 8^2 = 351.68 \quad \text{mm}^2 \quad \blacksquare > \blacksquare \quad A_{\text{perlu}} = 158.4 \quad \text{mm}^2$$